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Revealing Sources of CH_4 in a Boreal Upland Forest

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Background

- Boreal upland forests are important CH_4 sinks
- However, above canopy flux measurements indicate that boreal forests can act as occasional sources of CH_4
  - E.g. at the SMEAR II station in Finland in 2012
- New evidence that vegetation could act as a significant source of CH_4
  → Mechanisms are still uncertain
- Moreover, methanogens have been found from boreal trees
- **Where do the boreal forest CH_4 emissions originate from?**

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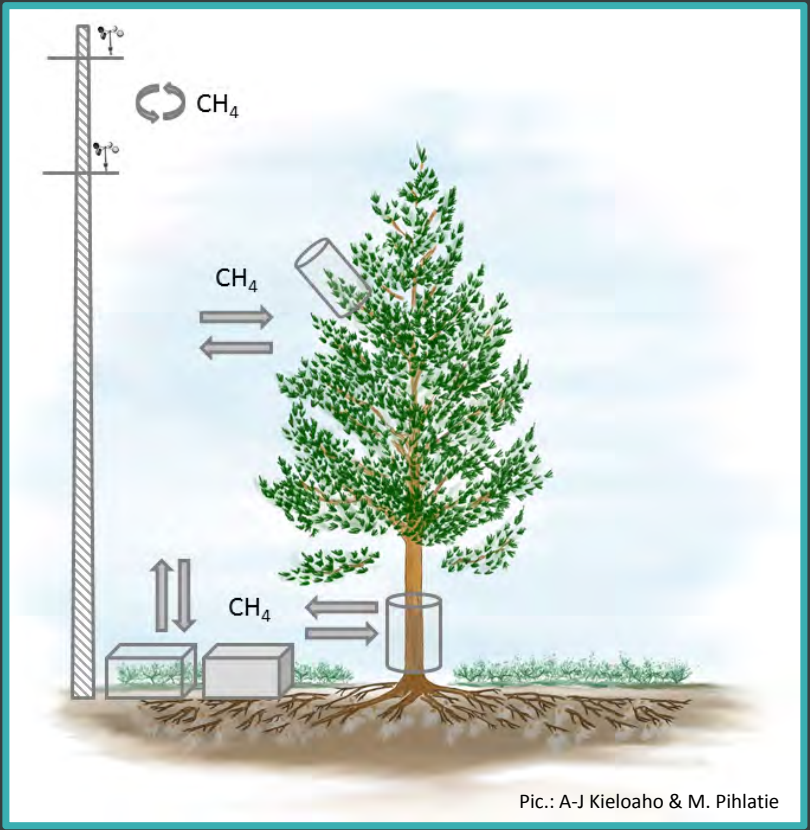
Overview of the METAFOR research project



Pic.: A-J Kieloaho & M. Pihlatie

- Above the canopy:
  - Concentration gradient measurements
- Trees:
  - Stem and shoot chambers
  - Poster: Machacova *et al.*
- Forest floor:
  - 54 soil chambers
- (Ground) vegetation, above- and belowground:
  - Laboratory experiment
- Microbes
  - Methanogens analyzed from the field and the laboratory experiment

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Methods: CH_4 flux above the forest canopy

- CH_4 concentration measurements at 16 m and 67 m
- The CH_4 flux is calculated from the concentrations with the modified Bowen-ratio technique

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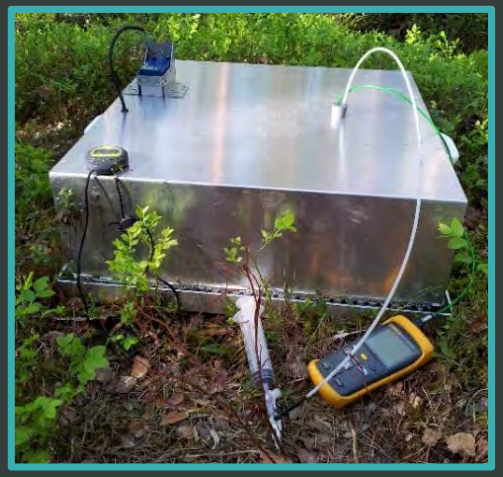
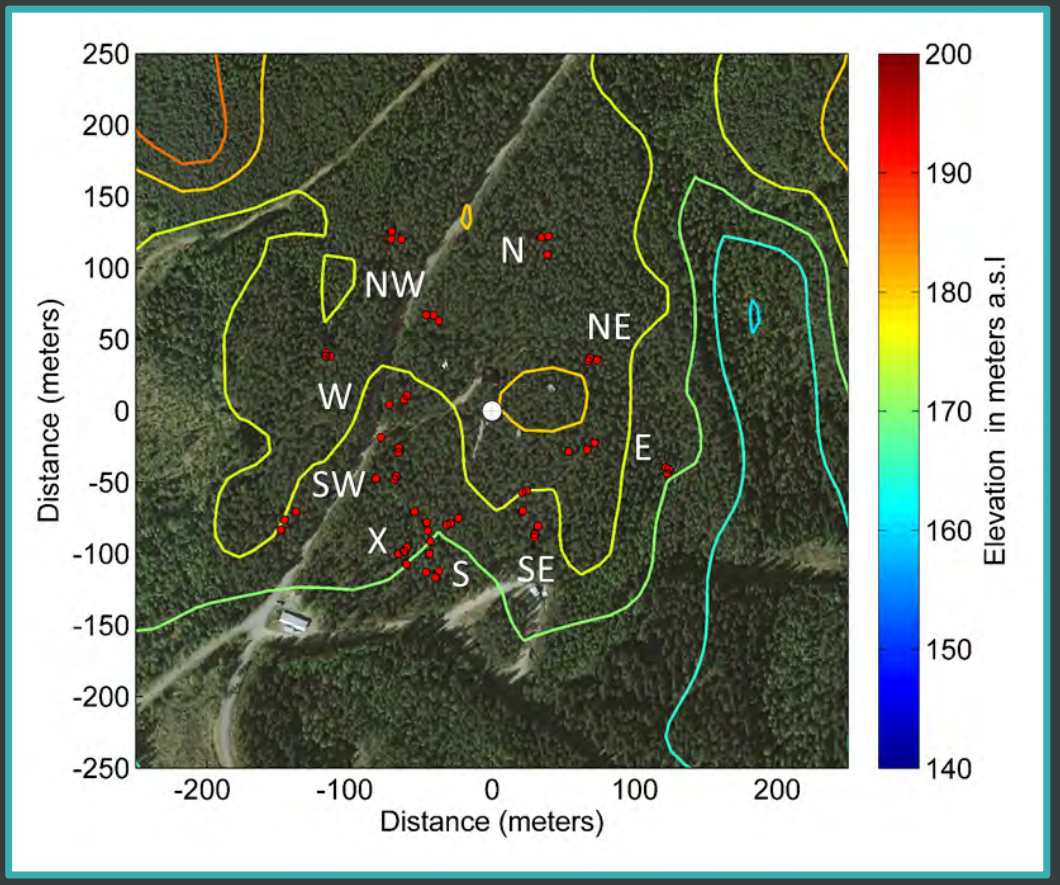
Methods: Forest Floor CH_4 flux

- 54 soil chambers covering the main source area of the above canopy CH_4 flux





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Methods:

Above- and belowground CH_4 fluxes from vegetation

- 4 plant species:
  - bilberry *(Vaccinium myrtillus)*
  - lingonberry *(Vaccinium vitis-idaea)*
  - heather *(Calluna vulgaris),* and
  - Scots pine *(Pinus sylvestris)*
- 8 individual plants from each species
- Also 11 controls without a plant, only humus soil
- Above- and belowground parts closed and measured separately

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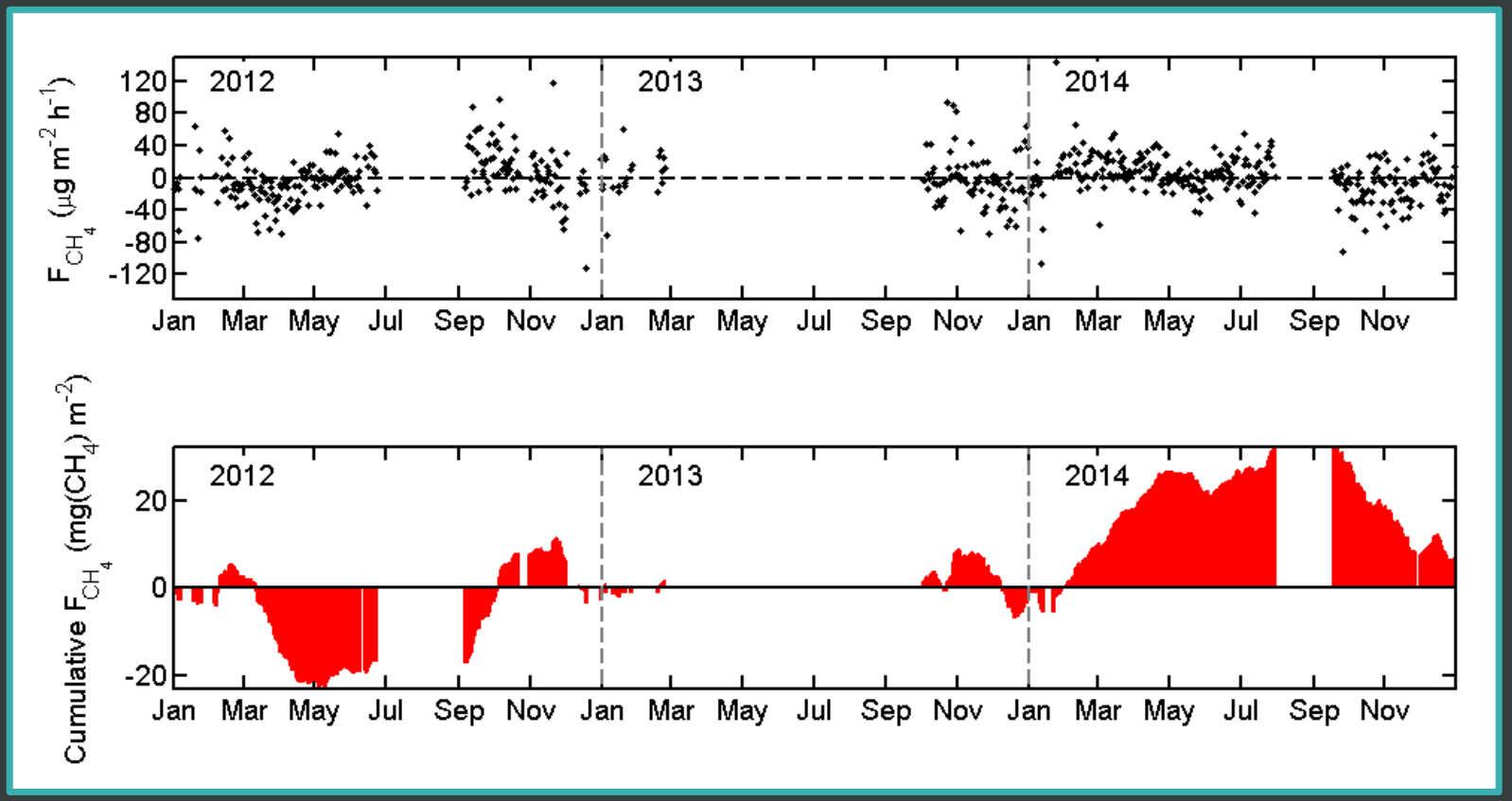
Results: Above the canopy – Daily medians and Cumulative flux



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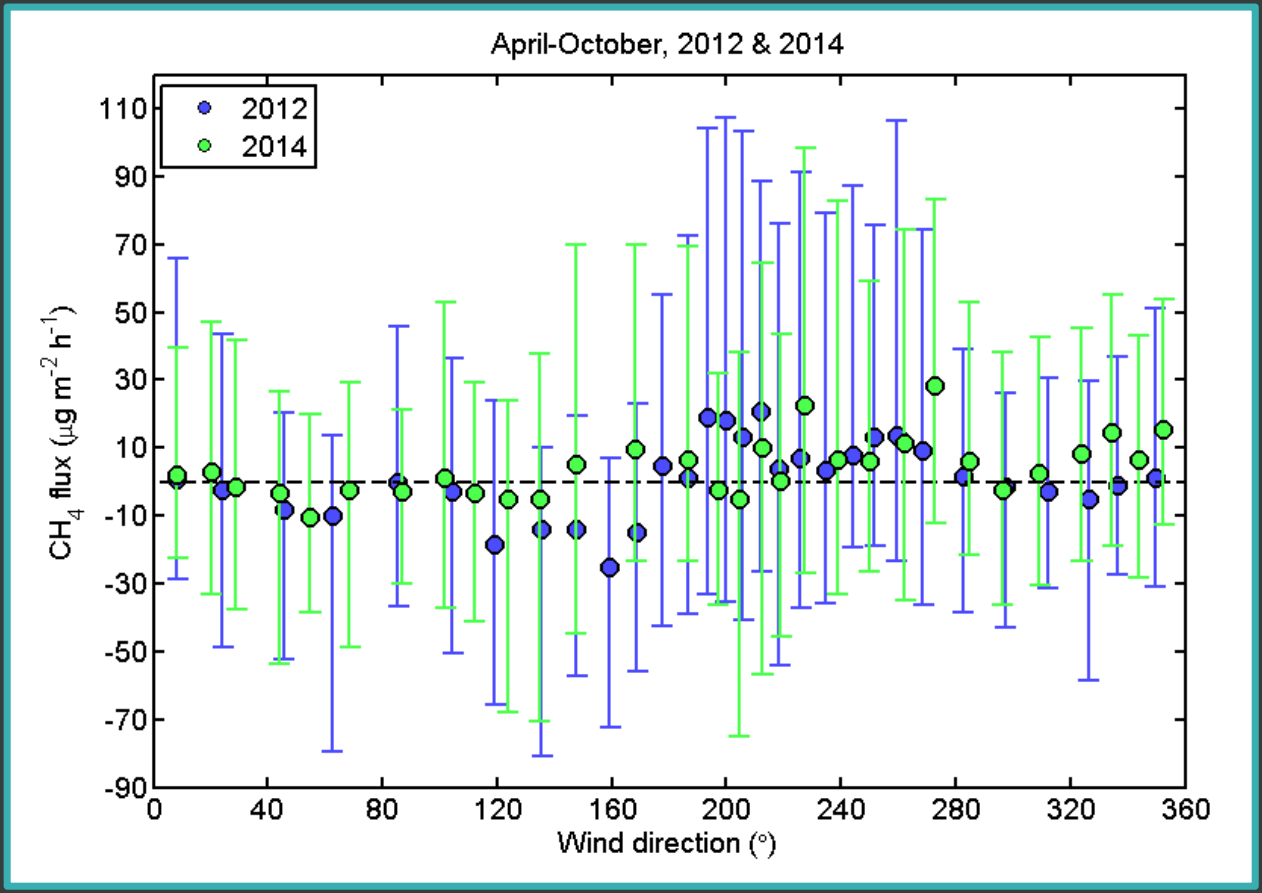
Results: Above the canopy – Flux vs. wind direction



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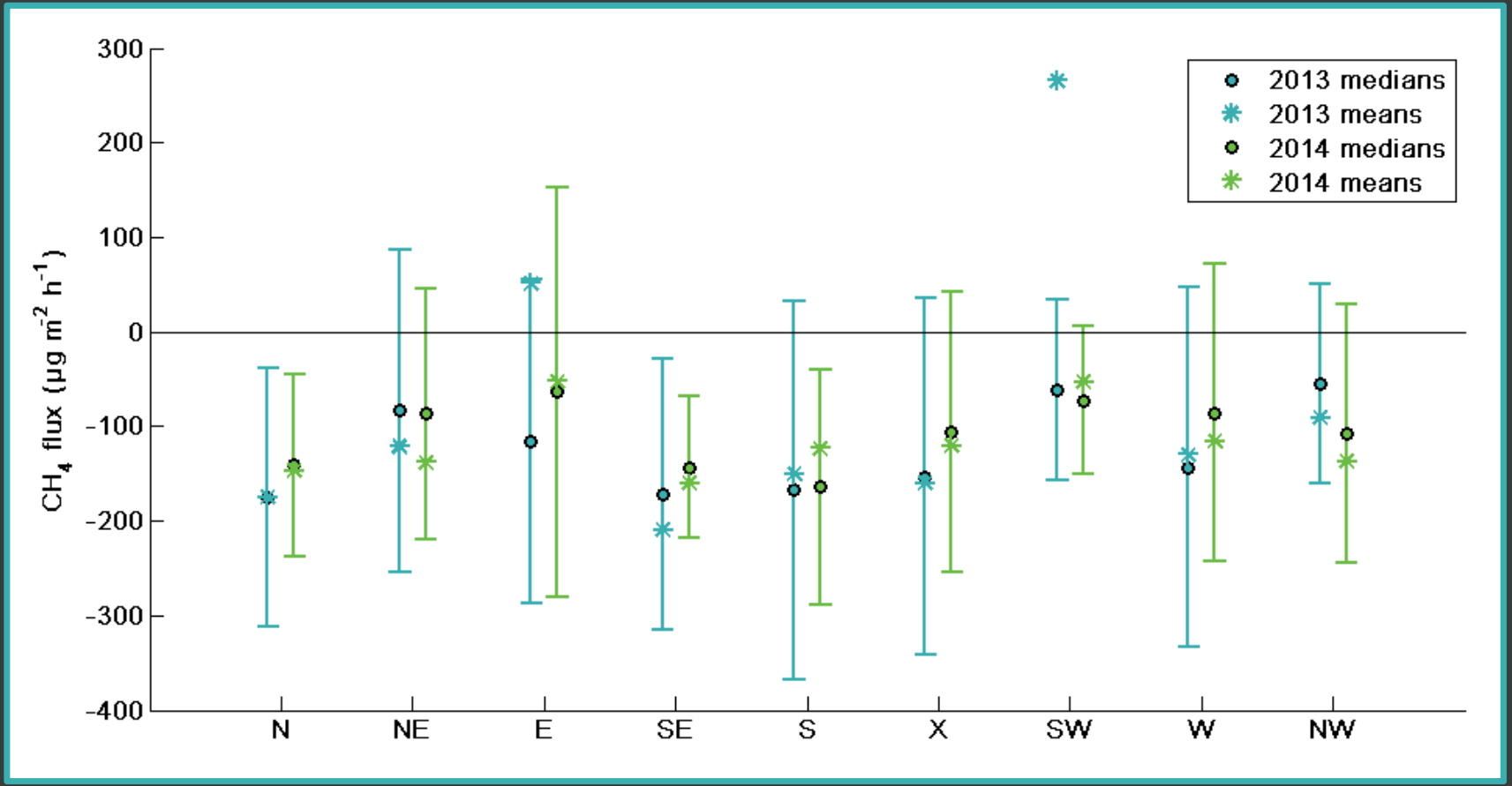
Results: Forest floor – Flux vs. wind direction



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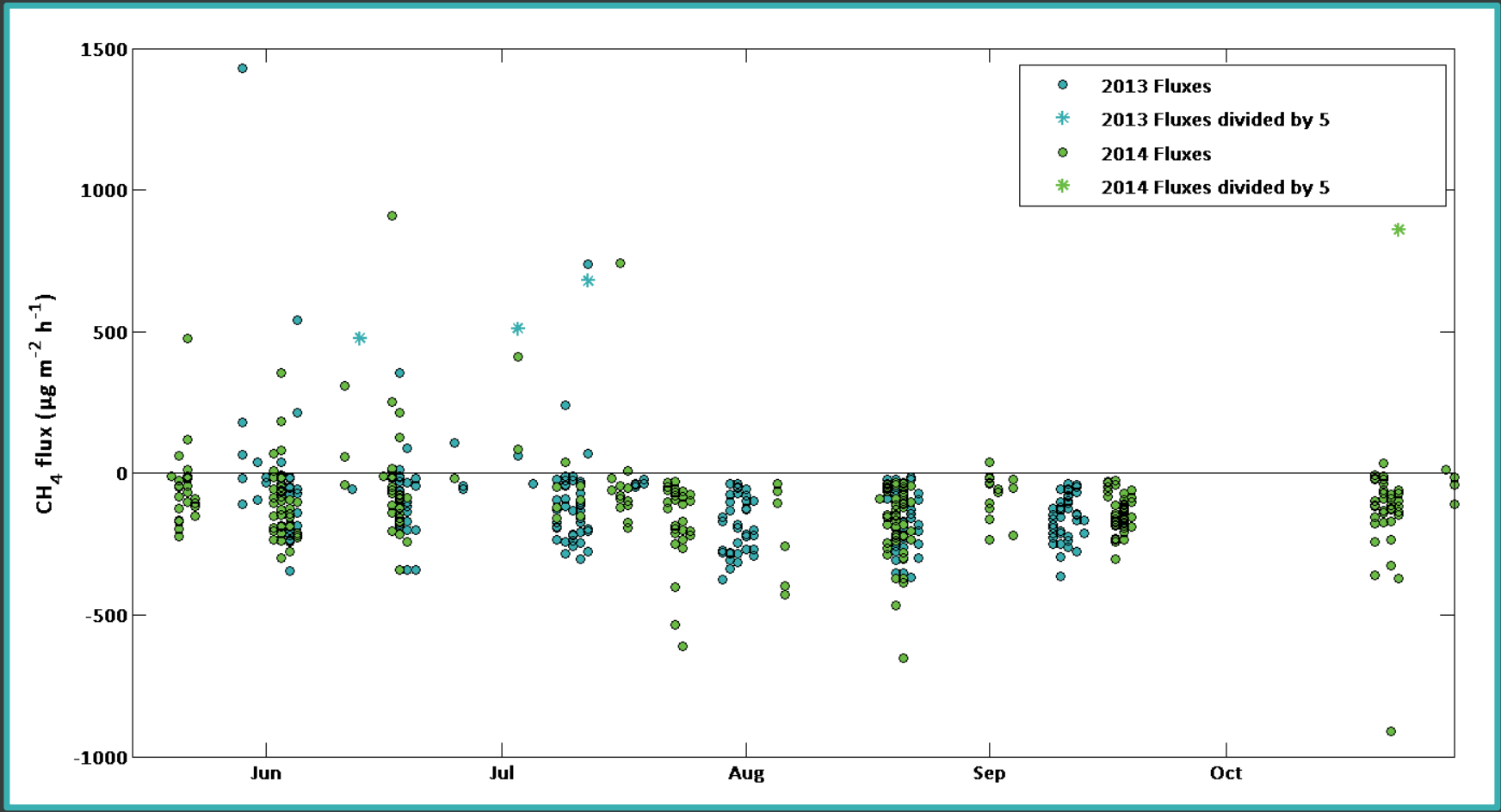
Results: Forest floor



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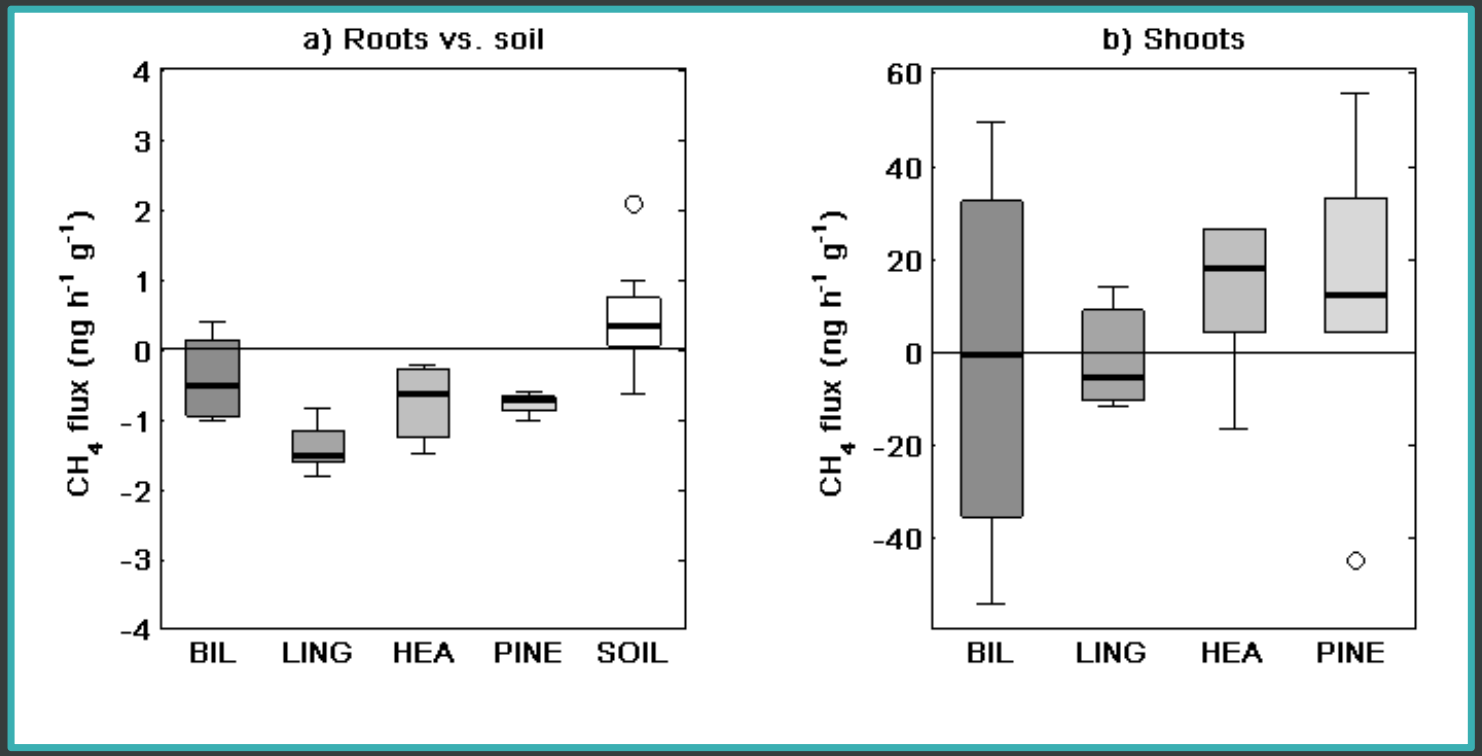
Results: Vegetation – above- and belowground fluxes



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Conclusions

- Occasional considerable CH_4 emissions from the forest floor and above the canopy
- The forest floor CH_4 emissions do not entirely explain the emissions detected above the canopy
- Shoots of heather and Scots pine emit CH_4
- Plant roots seem to induce CH_4 uptake in the soil
- **Vegetation may be the origin of CH_4 in boreal forests?**

THANK YOU!

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Results: Vegetation, above- and belowground